

**Claims:**

[30011470 US]

1. An optical notch filter apparatus for attenuating light of a predetermined wavelength, the apparatus comprising:

a dielectric optical element having a layer of metal disposed upon a surface thereof so as to form a metal/dielectric interface;

a dielectric medium adjacent the layer of metal, the dielectric medium having a dielectric constant different from a dielectric constant of the dielectric optical element;

wherein, when in use, light of a p-polarised state and the predetermined wavelength following a first propagation path so as to be incident upon the metal/dielectric interface is attenuated under conditions that support surface plasmon resonance; and

at least one polarisation modifying optical element arranged relative to the dielectric optical element so as, when in use, to translate the state of polarisation of light of an s-polarised state to the p-polarised state, thereby permitting light at the predetermined wavelength having both the p- and the s-polarised states to be attenuated.

2. An apparatus as claimed in Claim 1, further comprising a light-directing optical element arrangement to direct, when in use, light of the s-polarised state, or light once of the s-polarised state, along a second propagation path.

3. An apparatus as claimed in Claim 2, wherein the second propagation path is a return path.

4. An apparatus as claimed in Claim 2, wherein the at least one polarisation modifying optical element is disposed in the second propagation path so as to translate, when in use, the state of polarisation of light of the s-polarised state at least partly to the p-polarised state prior to reflection by the metal/dielectric interface.

5. An apparatus as claimed in Claim 2, wherein the at least one polarisation modifying optical element is disposed in the first propagation path so as to translate, when in use, the state of polarisation of light of the s-polarised state reflected by the metal/dielectric interface at least partly to the p-polarised state.
6. An apparatus as claimed in Claim 1, wherein the at least one polarisation modifying optical element is a phase retarder.
7. An apparatus as claimed in Claim 1, wherein the light-directing optical element arrangement comprises a prism.
8. An apparatus as claimed in Claim 1, wherein the light-directing optical element arrangement comprises a beam splitter and a reflecting element.
9. An apparatus as claimed in Claim 1, wherein the dielectric medium is a first dielectric layer.
10. An apparatus as claimed in Claim 9, further comprising a second dielectric layer disposed adjacent the first dielectric layer.
11. An apparatus as claimed in Claim 9, further comprising a control unit arranged to modify at least one property of the first dielectric layer and/or the second dielectric layer.
12. An apparatus as claimed in Claim 11, wherein the at least one property is thickness and/or refractive index.
13. An apparatus as claimed in Claim 1, wherein the first and/or second dielectric layer includes a layer of liquid crystal.
14. An apparatus as claimed in Claim 1, further comprising:

an additional layer of metal disposed upon another surface of the dielectric optical element so as to form an additional metal/dielectric interface, the another surface being substantially opposite the metal/dielectric interface.

15. An apparatus as claimed in Claim 14, further comprising:  
the dielectric medium adjacent the additional metal/dielectric interface.
16. An apparatus as claimed in Claim 14, further comprising a third dielectric layer adjacent the additional metal/dielectric interface.
17. An apparatus as claimed in Claim 16, further comprising a fourth dielectric layer disposed adjacent the third dielectric layer.
18. An optical filtering system comprising:  
an input for providing light from a source of light;  
an output for collecting light for onward propagation;  
a first optical notch filter apparatus and a second optical notch filter apparatus as claimed in any one of the preceding claims, the first optical notch filter apparatus being arranged to filter, when in use, light from the input, and the second optical notch filter apparatus being arranged to filter, when in use, light exiting the first optical notch filter apparatus;  
a light-directing optical element arrangement to direct light from the input to the first optical notch filter apparatus and from the second optical notch filter apparatus to the output.
19. A method of filtering out light of a predetermined wavelength, the method comprising:  
directing light so as to be incident upon a metal/dielectric interface, the light comprising light of a p-polarised state and an s-polarised state, the light of the p-polarised state and the predetermined wavelength being attenuated under conditions that support surface plasmon resonance; and

translating the state of polarisation of the light of the s-polarised state to the p-polarised state, thereby permitting light at the predetermined wavelength having both the p- and the s-polarised states to be attenuated substantially by the surface plasmon resonance.